A study on the effects of different time intervals from observation in particle tracking for cell migration

Feng Wei Yang,

University of Sussex

The Leverhulme Trust

F.W.Yang@sussex.ac.uk

23 May 2016

Recap

The work in the recent publication in JBM, we had focussed on *five* points:

- **Segmentation** using background reconstruction;
- **Particle tracking** using the nearest neighbour approach;
- **Information extraction (1)** for decisions on possible directional migration;
- **Whole cell tracking** through an optimal control model;
- **Information extraction (2)** for volume and mass changes.

Next

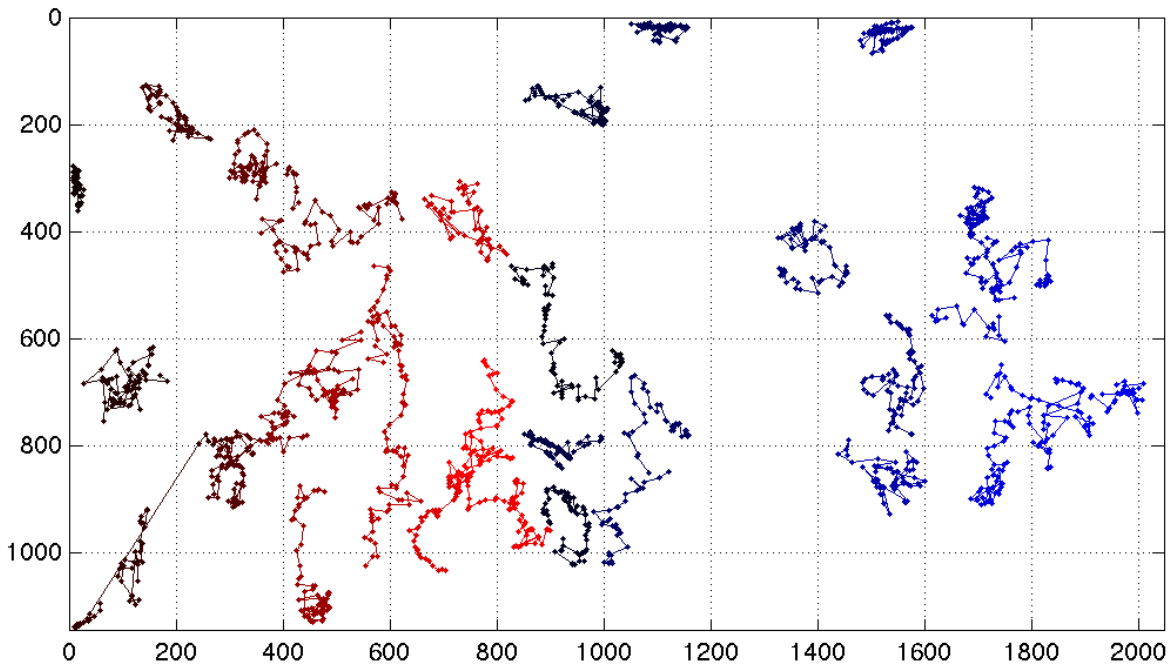
The current work will mainly focus on **particle tracking** and the related **information extraction**.
We will need to address **segmentation** but no novelty is expected from this.
The whole cell tracking will be in a different project entirely.

Step 1: segmentation

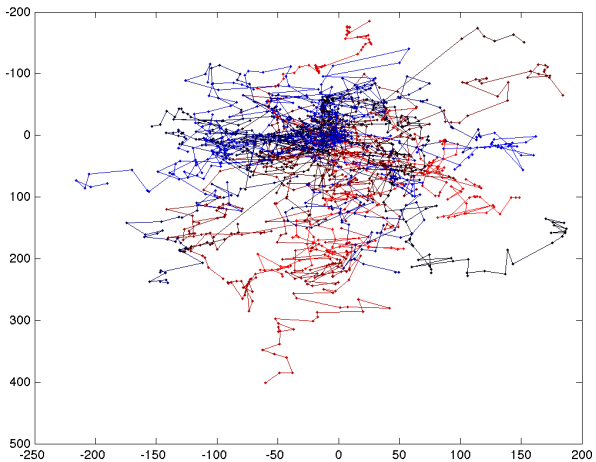
Our original segmentation

New segmentation

Step 2: Cell tracking with original approach



Results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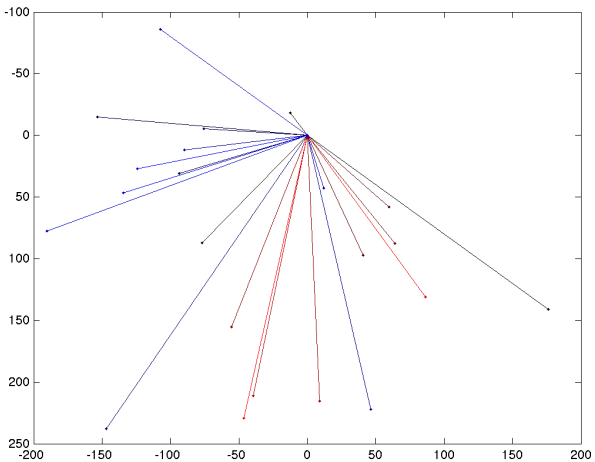
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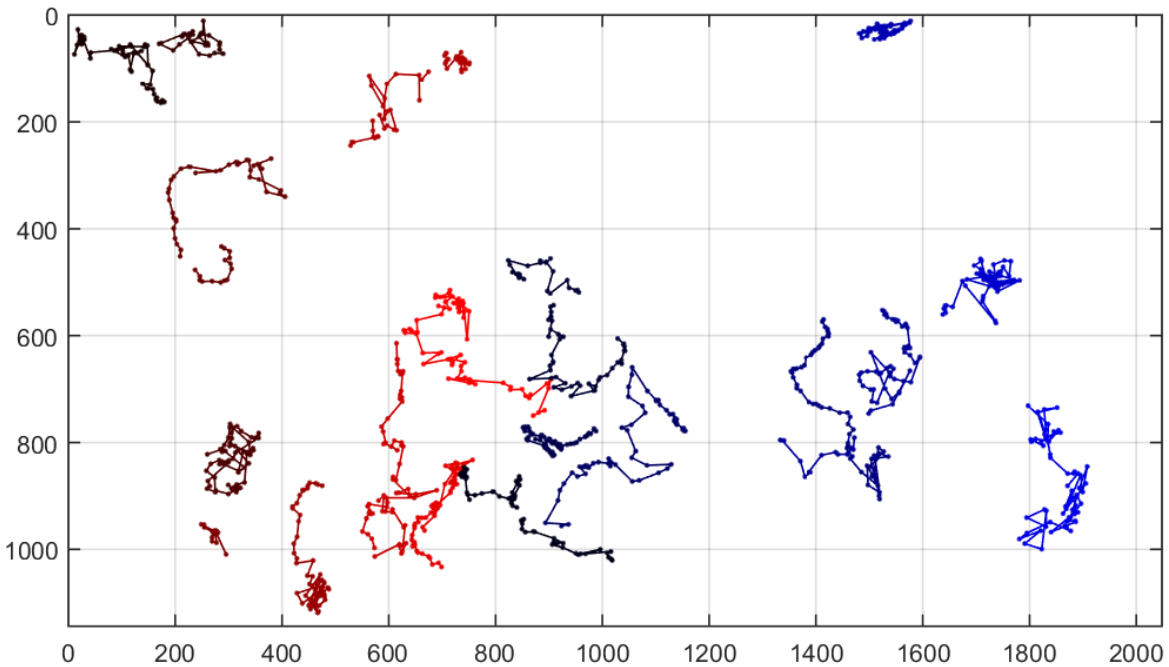
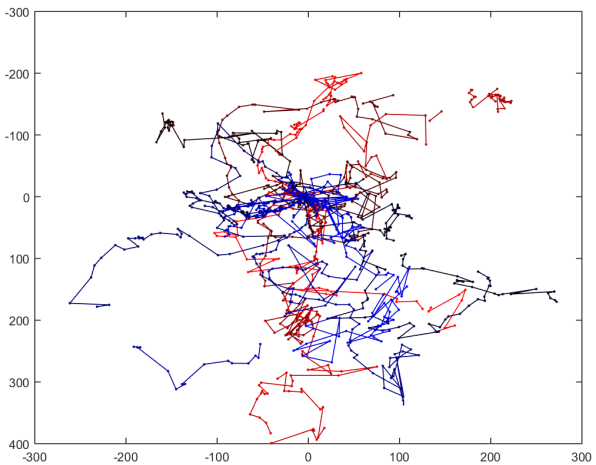
Cell tracking with new segmentation



Results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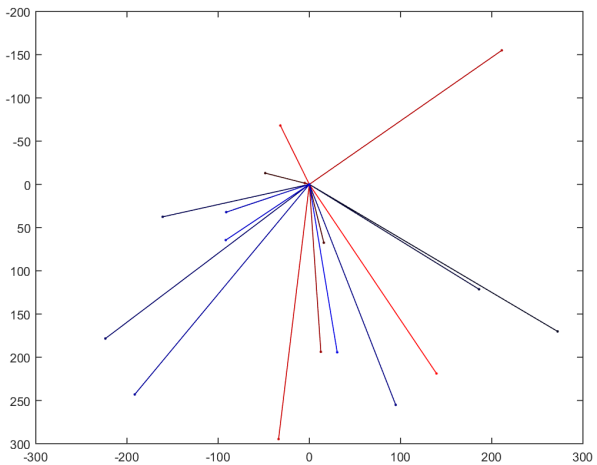
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Cell tracking approaches revisit

Treat collisions as cells.
This approach aims to find the maximum possible trajectories.

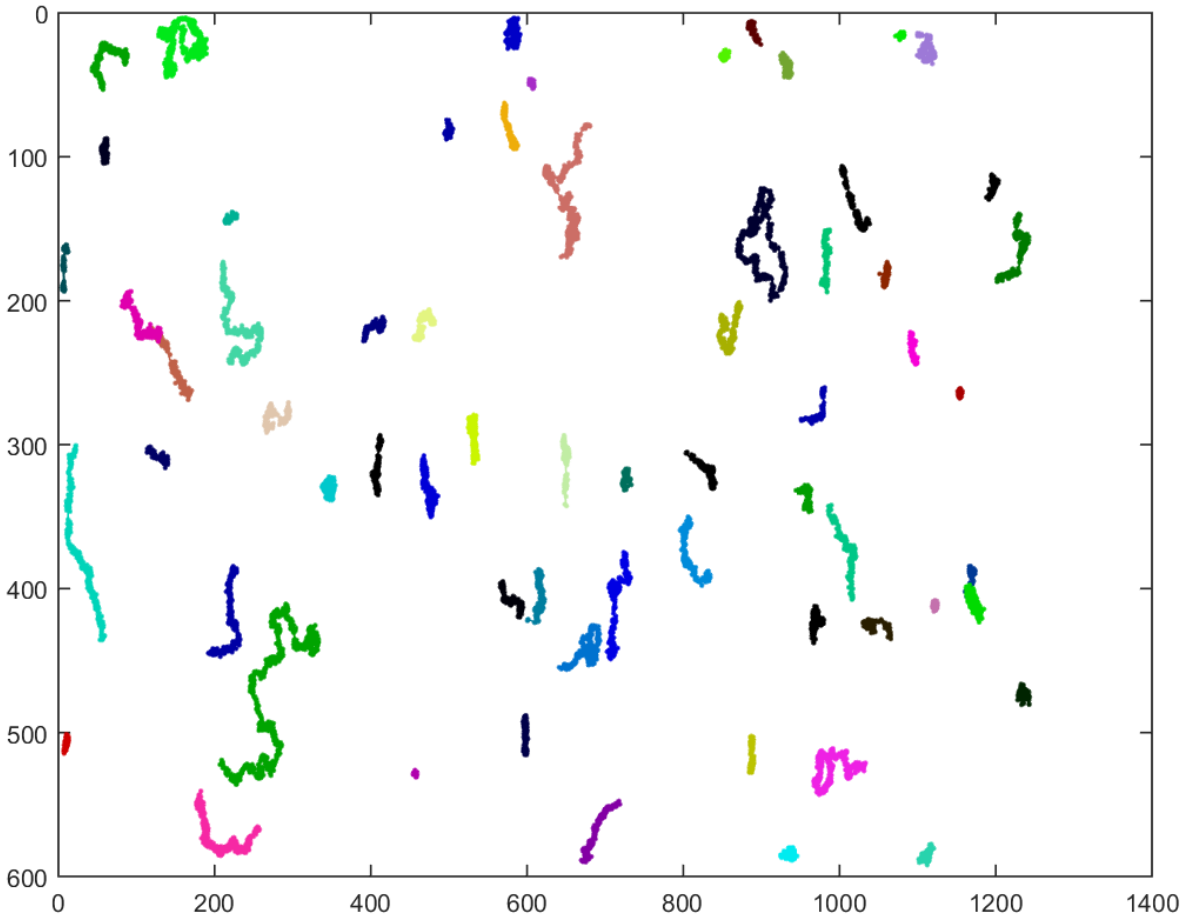
Avoid collisions.
This only looks for well-defined, isolated cells and trajectories are short.

Step 3: accuracy test with different time intervals

An increased data volume

- 2880 frames,
- Folder for the segmented pictures is more than 1GB,
- To find the global minimum is very time costly.
- Short-sequence cell tracking has greatly increased the number of possible starting cells
- Plotting imposed a very demanding memory requirement (at least 20GB to partially plots 30,000 sequences).

Only short-sequence cell tracking has results so far



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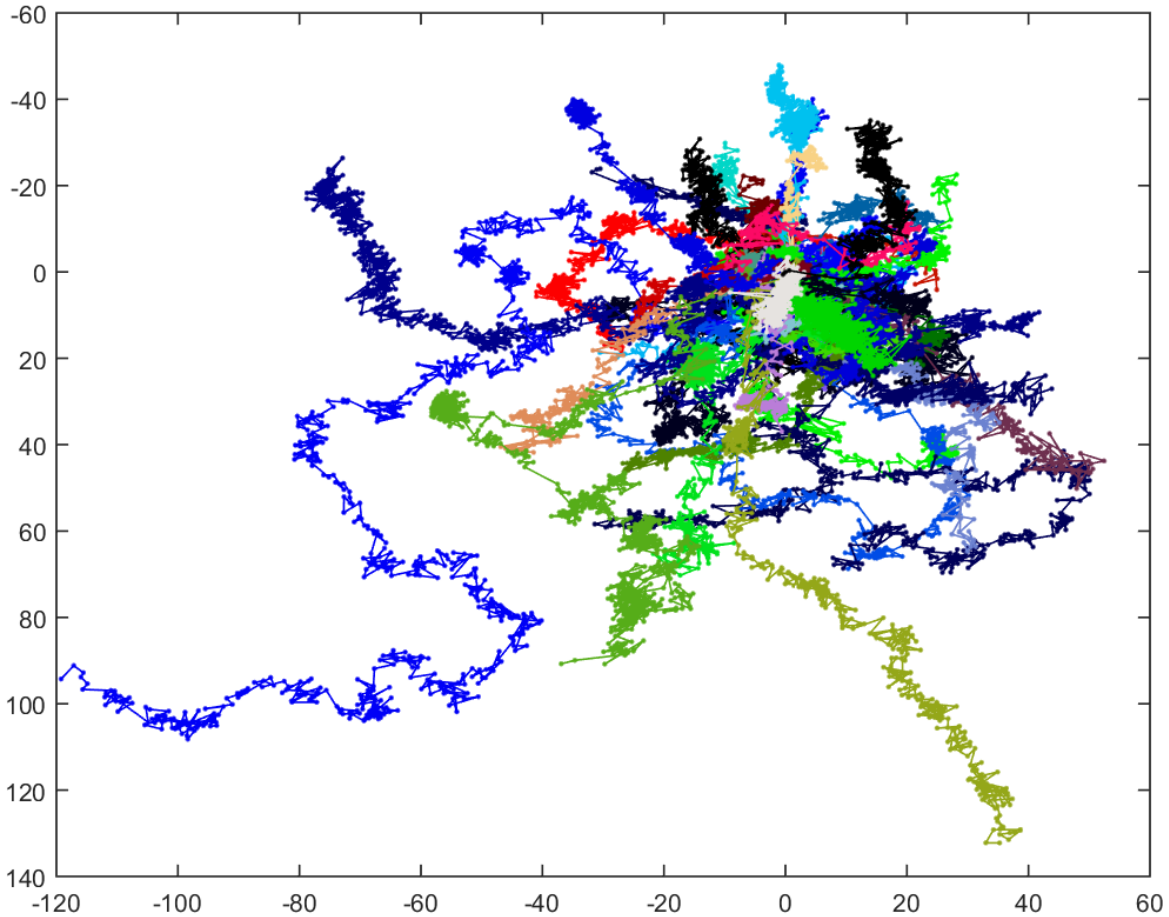
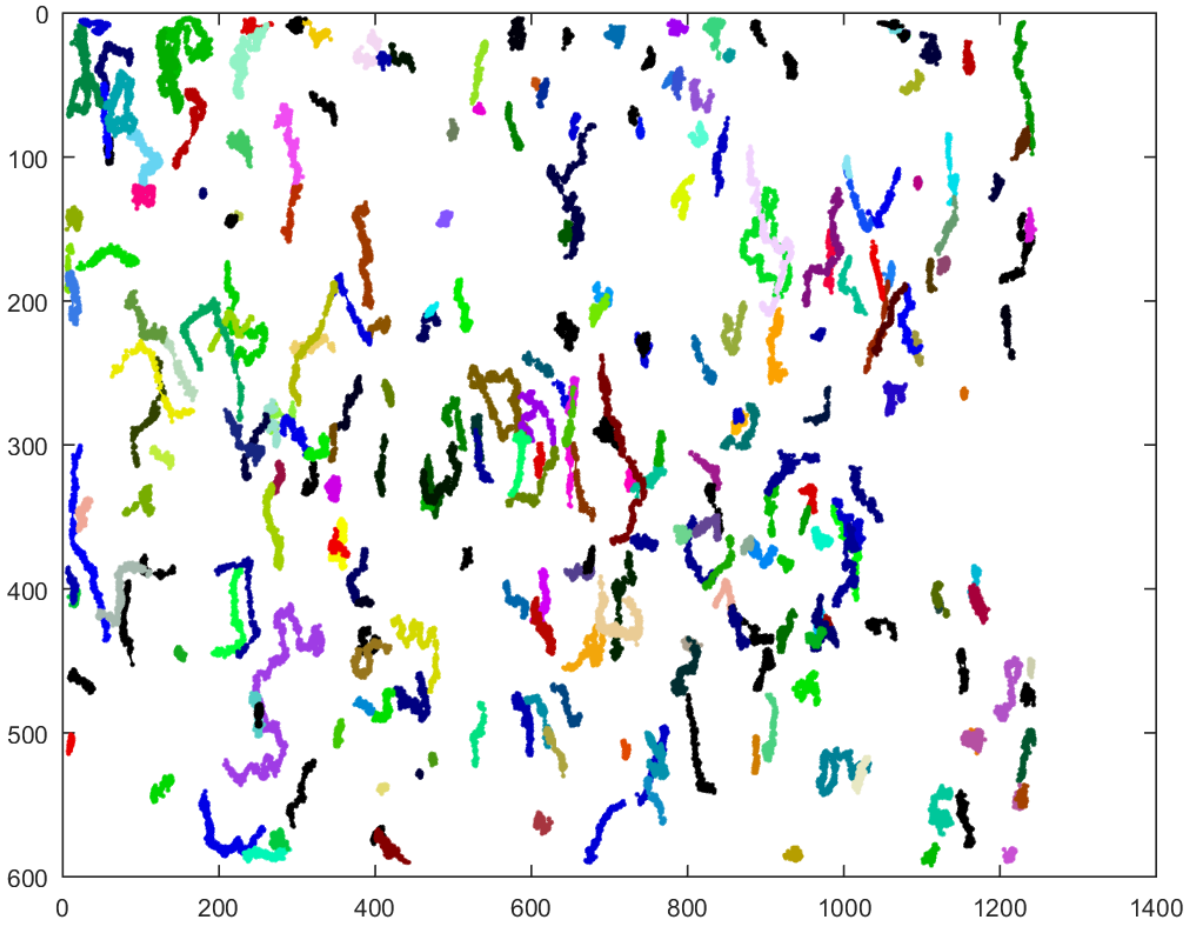


30,000 cells



Information extraction

Image and trajectory properties can easily be computed,

- distance traveled (not suitable for short sequence)
- overall speed (averaged speed)
- initial speed and speed while invadopodia took place
- wiggling angles
- circularly + area to determine when the invadopodia happens

Extra: Cell proliferation